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IN REPLY REFER TO: Joint Interoperability Test Command (JTE)

Ser JT4/1225
18 February 2010

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Fujitsu FLASHWAVE 9500 Packet Optical Network Platform with Dense Wavelength Division Multiplexing based Reconfigurable Optical Add-Drop Multiplexer feature with Software Release 3.1

References: (a) Department of Defense Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) Chairman, Joint Chiefs of Staff Instruction 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(c) and (d), see enclosure 1

1. References (a) and (b) establish the Joint Interoperability Test Command (JITC) as the responsible organization for interoperability test certification.

2. The Fujitsu FLASHWAVE 9500 Packet Optical Network Platform with Dense Wavelength Division Multiplexing based Reconfigurable Optical Add-Drop Multiplexer feature with Software Release 3.1 will hereinafter be referred to as the System Under Test (SUT).

The SUT met all tested critical interoperability requirements as set forth by the Unified Capabilities Requirements (UCR) 2008 (reference [c]) and is certified as interoperable for use with the Defense Information Systems Network (DISN) in accordance with UCR, section 5.5.2 Optical Transport Systems. The JITC does not certify, and the DISN Program Management Office has not authorized, any other configurations, features, or functions, except those cited in this memorandum. This certification expires upon changes that affect interoperability, but no later than Three years from the date of this memorandum.

3. The JITC bases these findings on UCR testing, DISN Interoperability (IOP) testing, and review of the vendor's Letters of Compliance. The JITC conducted UCR testing and DISN IOP testing at the Advanced Technology Test Facility, Indian Head, Maryland during August and September 2009. The JITC Information Assurance (IA) test team completed IA testing and published their findings in a separate report (reference [d]). The Certification Testing Summary (Enclosure 2) describes the test configurations and documents the UCR and DISN IOP test results.

4. Table 1 shows the SUT Overall Test Summary and Table 2 lists the Overall Capability and Feature Requirements used to evaluate the SUT IOP.

Table 1. SUT Overall Test Summary

UCR Test Interfaces			
UCR Section 5.5.2 Required Interfaces	**Required**	**Status**	**Remarks**
OC-48	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OC-192	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
OC-768	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
1 Gigabit Ethernet	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
10 Gigabit Ethernet-WAN	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
10 Gigabit Ethernet-LAN	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
STM-16	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
STM-64	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
STM-256	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OTU1/ODU1	Yes	Certified	Met CRs and FRs via Fujitsu LOCs
OTU2/ODU2	Yes	Certified	Met CRs and FRs via Fujitsu LOCs
OTU3/ODU3	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
DISN Interoperability Test Interfaces			
DISN Required Interfaces	**Required**	**Status**	**Remarks**
OC-48	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OC-192	Yes	Certified	Met all CRs and FRs.
1 Gigabit Ethernet	Yes	Certified	Met all CRs and FRs.
10 Gigabit Ethernet-WAN	Yes	Certified	Met all CRs and FRs.
10 Gigabit Ethernet-LAN	Yes	Certified	Met all CRs and FRs
Features and Capabilities			
Features and Capabilities	**Required**	**Status**	**Remarks**
System Administration	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
System Performance	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
System Protection	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
Security (Information Assurance)	Yes	See note 1	See note 1.

NOTES:
1 The Joint Interoperability Test Command Information Assurance test teams tested security and published the results in a separate report.

LEGEND:

CR	Capability Requirements	ODU	Optical Channel Data Unit
DISN	Defense Information Systems Network	OTU	Optical Channel Transport Unit
FR	Feature Requirements	STM	Synchronous Transport Module
LAN	Local Area Network	SUT	System Under Test
LOC	Letter of Compliance	UCR	Unified Capabilities Requirements
OC	Optical Carrier	WAN	Wide Area Network

Table 2. SUT Overall Capability and Feature Requirements

UCR Test Interfaces			
Interface	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
OC-48	Yes	OC-48 and 2.5G interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.1
OC-192	Yes	OC-192 interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
OC-768	Yes	OC-768 and 40G interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6
Gigabit Ethernet	Yes	1 Gigabit Ethernet interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.3 UCR 2008, Section 5.3.3.4.1, 5.3.3.5.1, 5.3.3.6.1
10 Gigabit Ethernet-WAN	Yes	10 Gigabit Ethernet-WAN interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.4
10 Gigabit Ethernet-LAN	Yes	10 Gigabit Ethernet-LAN interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.5
STM-16	Yes	STM-16 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.1
STM-64	Yes	STM-64 interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
STM-256	Yes	STM-256 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6
OTU1/ODU1	Yes	OTU1/ODU1 interface requirements (R)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
OTU2/ODU2	Yes	OTU2/ODU2 interface requirements (R)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
OTU3/ODU3	Yes	OTU3/ODU3 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
DISN Interoperability Test Interfaces			
Interface	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
OC-48	Yes	DISN OTS interoperability requirements for OC-48 interface (R) (See Note-1)	DISN-OTS-IOP-01, 19, 20, 24, 25.
OC-192	Yes	DISN OTS interoperability requirements for OC-192 interface (R)	DISN-OTS-IOP-01, 02, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 21, 22, 23, 26, 27.
Gigabit Ethernet	Yes	DISN OTS interoperability requirements for Gigabit Ethernet interface (R)	DISN-OTS-IOP-01, 04, 17.
10 Gigabit Ethernet-WAN	Yes	DISN OTS interoperability requirements for 10 Gigabit Ethernet-WAN interface (R)	DISN-OTS-IOP-01, 16.
10 Gigabit Ethernet-LAN	Yes	DISN OTS interoperability requirements for 10 Gigabit Ethernet-LAN interface (R)	DISN-OTS-IOP-01, 15, 18.
SUT Features and Capabilities			
Feature/Capability	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
System Administration	Yes	System Provisioning Options (EMS/NMS Operations Stand Alone and Via OSC) (R)	UCR 2008, Section 5.5.2.1.1.6, 5.5.2.1.2.1.1, 5.5.2.1.2.1.2, 5.5.2.1.2.1.3, 5.5.2.6.1, 5.5.2.6.2, 5.5.2.6.3, 5.5.2.6.4, 5.5.2.6.5, 5.5.2.6.6, 5.5.2.6.7, 5.5.2.10. DISN-OTS-IOP-01.
		Fault Management Options (Internal BERT, Equipment Redundancy, ALS, and Housekeeping Alarms Capability) (R)	UCR 2008, Section 5.5.2.5.3, 5.5.2.8.12, 5.5.2.8.38, 5.5.2.9.20.
		Software Upgrade/Downgrade and Configuration Backup/Restoral Options (R)	UCR 2008, Section 5.5.2.8.40, 5.5.2.8.43, 5.5.2.8.44, 5.5.2.8.45, 5.5.2.8.39.
		Wavelength Management Options (Tuning, Addition and Deletion of Wavelength) (R)	UCR 2008, Section 5.5.2.5.1, 5.5.2.5.2, 5.5.2.1.13, 5.5.2.11.12, 5.5.2.11.13, 5.5.2.11.19.
System Performance	Yes	System Protection Options (Manual and Automatic Path Protection and Restoral) (R) Voice over Internet Protocol SIP and H.323 performance via Gigabit Ethernet (R)	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29, DISN-OTS-IOP-17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27. UCR 2008, Section 5.3.3.4.1, 5.3.3.5.1, 5.3.3.6.1

Table 2. SUT Overall Capability and Feature Requirements (continued)

SUT Features and Capabilities			
Feature/Capability	**Critical**	**Requirements Required (R) or Conditional (C)**	**References**
System Protection	Yes	System Protection Options (Manual and Automatic Path Protection and Restoral) (R)	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29, DISN-OTS-IOP-17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27.
Security (Information Assurance)	Yes	Defense Information Assurance Certification and Accreditation Process and Security Technical Implementation Guides (R)	UCR 2008 Section A9.6
NOTES: 1 These interfaces are not supported by the system and have not been tested.			

LEGEND:

BERT	Bit Error Ratio Test	NMS	Network Management System	R	Required
C	Conditional	OC	Optical Carrier	SIP	Session Initiation Protocol
DISN	Defense Information Systems Network	ODU	Optical Channel Data Unit	STM	Synchronous Transport Module
EMS	Element Management System	OSC	Optical Supervisory Channel	SUT	System Under Test
IOP	Interoperability	OTS	Optical Transport System	UCR	Unified Capabilities Requirements
LAN	Local Area Network	OTU	Optical Channel Transport Unit	WAN	Wide Area Network

5. In accordance with the Program Manager's request, the JITC did not prepare a detailed test report. The JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program, which .mil/gov users can access on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (Secure Internet Protocol Router Network).

6. The JITC point of contact is Mr. Derwin Collins, DSN 354-2620, commercial (301) 744-2620, FAX DSN 354-2688, or e-mail address is derwin.collins@disa.mil. The tracking number for the SUT is TN 0915502. The JITC mailing address is 3341 Strauss Avenue, Suite 236, Indian Head, Maryland 20640-5149.

FOR THE COMMANDER:

Germaine M. Forbes

2 Enclosures a/s

for RICHARD A. MEADOR
Chief, Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Fujitsu FLASHWAVE 9500 Packet Optical Network Platform with Dense Wavelength Division Multiplexing based Reconfigurable Optical Add-Drop Multiplexer feature with Software Release 3.1

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ADDITIONAL REFERENCES

(c) Office of Assistant Secretary of Defense for Networks and Information Integration/ Department of Defense (DoD) Chief Information Officer Document, "Department of Defense Unified Capabilities Requirements 2008," 22 January 2009

(d) Joint Interoperability test Command, "Information Assurance (IA) Assessment of Fujitsu FLASHWAVE 9500 with Software Release 3.1 (TN 0915503)," 1 October 2009

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CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. The Fujitsu FLASHWAVE 9500 packet Optical Network Platform (ONP) with Dense Wavelength Division Multiplexing (DWDM) based Reconfigurable Optical Add-Drop Multiplexer (ROADM) feature and its components described in paragraph 5.a through 5.c hereinafter referred to as the System Under Test (SUT)

2. PROPONENTS. United States (US) Army, Headquarters (HQ) United States Army Information Systems Engineering Command

3. PROGRAM MANAGER. Mr. Gary Kitsmiller, AMSEL-IE-IS, Bldg 53301, Fort Huachuca, Arizona, 85613-5300, email: gary.kitsmiller@us.army.mil

4. TESTER. Joint Interoperability Test Command (JITC), Indian Head Maryland.

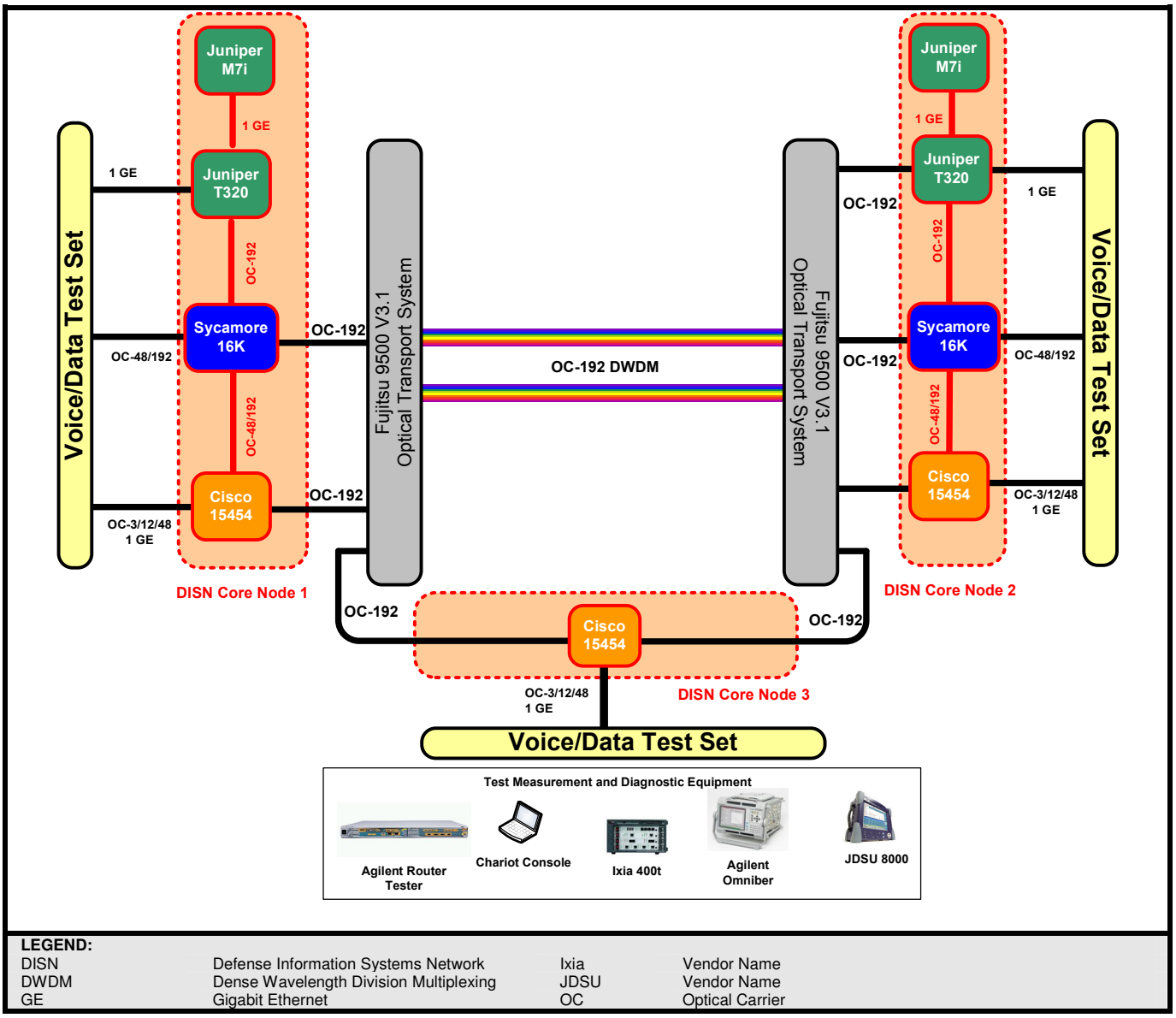
5. SYSTEM UNDER TEST DESCRIPTION. The SUT is a pluggable DWDM based ROADM platform that enables packet fabric access and Synchronous Digital Hierarchy (SDH), and Synchronous Optical Network (SONET) fabric access to transport multiple services. A transport network element uses packet optical transport for transport of SONET, Packet, and Optical Transport Network (OTN) switch with a universal Switch Fabric. At full ROADM optical performance, it provides 24 node support, 1200 km distances, 35dB, 480G SONET Transport switching capacity, 480G Packet switching capacity, and provides up to 88 wavelengths services. Fujitsu designed the system to add value to the Department of Defense (DoD) networks by enabling the DoD to aggregate and transport traffic efficiently.

The following is a brief narrative for the hardware and software platforms included in the SUT:

a. FLASHWAVE 9500 ONP with DWDM based ROADM feature with Software Release 3.1
b. NetSmart 500 EMS Software Release 3.12.0 is a Windows-based craft interface tool. The NetSmart 500 software supports graphical shelf views, equipment and facility provisioning, alarm surveillance, software download, remote memory backup, and remote memory restore capabilities, and cross-connect provisioning. Only used for configuration purposes and is not certified as a part of the SUT.
c. NetSmart 1500 NMS Software Release 6.0 provides a full suite of network and element management features, enabling turn up of Ethernet, Wavelength Division Multiplexing, SDH, and SONET services. Only used for configuration purposes and is not certified under the SUT

Although the SUT supports SONET and SDH standards, the SUT does not support Optical Carrier (OC)-48, OC-768 and Synchronous Transport Module (STM)-16, STM-256 interfaces; therefore, the JITC did not test these interfaces and the DISN Program Management Office has not authorized them for use with the DISN.

6. OPERATIONAL ARCHITECTURE. The SUT falls under the Optical Transport Systems Unified Capabilities Requirements (UCR). Figure 2-1 illustrates the JITC Indian Head Advanced Technologies Test bed configuration, which simulates the Defense Information Systems Network (DISN) operational architecture.



LEGEND:

DISN	Defense Information Systems Network	Ixia	Vendor Name
DWDM	Dense Wavelength Division Multiplexing	JDSU	Vendor Name
GE	Gigabit Ethernet	OC	Optical Carrier

Figure 2-1. Indian Head Advanced Technologies Test Bed

7. REQUIRED SYSTEM INTERFACES. The JITC selected requirements for UCR Compliance testing from UCR 2008 and derived requirements for DISN Interoperability (IOP) testing from actual DISN deployment at different theaters. The JITC also reviewed the vendor's Letters of Compliance (LOC) for certain UCR requirement that

were not testable at the time of testing. Table 2-1 shows the SUT Overall Test Summary and Table 2-2 lists the Overall Capability and Feature Requirements used to evaluate the SUT interoperability.

Table 2-1. SUT Overall Test Summary

UCR Compliance Test Interfaces			
UCR Section 5.5.2 Required Interfaces	**Required**	**Status**	**Remarks**
OC-48	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OC-192	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
OC-768	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
1 Gigabit Ethernet	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
10 Gigabit Ethernet-WAN	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
10 Gigabit Ethernet-LAN	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
STM-16	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
STM-64	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
STM-256	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OTU1/ODU1	Yes	Certified	Met CRs and FRs via Fujitsu LOCs
OTU2/ODU2	Yes	Certified	Met CRs and FRs via Fujitsu LOCs
OTU3/ODU3	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
DISN Interoperability Test Interfaces			
DISN Required Interfaces	**Required**	**Status**	**Remarks**
OC-48	Yes	Not-Certified	Currently this feature is not supported by the system and has not been tested.
OC-192	Yes	Certified	Met all CRs and FRs.
1 Gigabit Ethernet	Yes	Certified	Met all CRs and FRs.
10 Gigabit Ethernet-WAN	Yes	Certified	Met all CRs and FRs.
10 Gigabit Ethernet-LAN	Yes	Certified	Met all CRs and FRs
Features and Capabilities			
Features and Capabilities	**Required**	**Status**	**Remarks**
System Administration	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
System Performance	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
System Protection	Yes	Certified	Met CRs and FRs via combination of testing and Fujitsu LOCs
Security (IA)	Yes	See note 1.	See note 1.

NOTES:
1 The JITC Information Assurance test teams evaluated security and published results in a separate report.

LEGEND:

CR	Capability Requirements	ODU	Optical Channel Data Unit
DISN	Defense Information Systems Network	OTU	Optical Channel Transport Unit
FR	Feature Requirements	STM	Synchronous Transport Module
JITC	Joint Interoperability Test Command	SUT	System Under Test
LAN	Local Area Network	UCR	Unified Capabilities Requirements
LOC	Letter of Compliance	WAN	Wide Area Network
OC	Optical Carrier		

Table 2-2. SUT Overall Capability and Feature Requirements

UCR Test Interfaces			
Interface	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
OC-48	Yes	OC-48 and 2.5G interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.1
OC-192	Yes	OC-192 interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
OC-768	Yes	OC-768 and 40G interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6
Gigabit Ethernet	Yes	1 Gigabit Ethernet interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.3 UCR 2008, Section 5.3.3.4.1, 5.3.3.5.1, 5.3.3.6.1
10 Gigabit Ethernet-WAN	Yes	10 Gigabit Ethernet-WAN interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.4
10 Gigabit Ethernet-LAN	Yes	10 Gigabit Ethernet-LAN interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.5
STM-16	Yes	STM-16 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.1
STM-64	Yes	STM-64 interface requirements (R)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
STM-256	Yes	STM-256 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6
OTU1/ODU1	Yes	OTU1/ODU1 interface requirements (R)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
OTU2/ODU2	Yes	OTU2/ODU2 interface requirements (R)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
OTU3/ODU3	Yes	OTU3/ODU3 interface requirements (R) (See Note-1)	UCR 2008, Section 5.5.2.1.2.1.3, 5.5.2.6.7
DISN Interoperability Test Interfaces			
Interface	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
OC-48	Yes	DISN OTS interoperability requirements for OC-48 interface (R) (See Note-1)	DISN-OTS-IOP-01, 19, 20, 24, 25.
OC-192	Yes	DISN OTS interoperability requirements for OC-192 interface (R)	DISN-OTS-IOP-01, 02, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 21, 22, 23, 26, 27.
Gigabit Ethernet	Yes	DISN OTS interoperability requirements for Gigabit Ethernet interface (R)	DISN-OTS-IOP-01, 04, 17.
10 Gigabit Ethernet-WAN	Yes	DISN OTS interoperability requirements for 10 Gigabit Ethernet-WAN interface (R)	DISN-OTS-IOP-01, 16.
10 Gigabit Ethernet-LAN	Yes	DISN OTS interoperability requirements for 10 Gigabit Ethernet-LAN interface (R)	DISN-OTS-IOP-01, 15, 18.
SUT Features and Capabilities			
Feature/Capability	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
System Administration	Yes	System Provisioning Options (EMS/NMS Operations Stand Alone and Via OSC) (R)	UCR 2008, Section 5.5.2.1.1.6, 5.5.2.1.2.1.1, 5.5.2.1.2.1.2, 5.5.2.1.2.1.3, 5.5.2.6.1, 5.5.2.6.2, 5.5.2.6.3, 5.5.2.6.4, 5.5.2.6.5, 5.5.2.6.6, 5.5.2.6.7, 5.5.2.10. DISN-OTS-IOP-01.

Table 2-2. SUT Overall Capability and Feature Requirements (continued)

SUT Features and Capabilities			
Feature/Capability	**Required**	**Requirements Required (R) or Conditional (C)**	**References**
System Administration	Yes	Fault Management Options (Internal BERT, Equipment Redundancy, ALS, and Housekeeping Alarms Capability) (R)	UCR 2008, Section 5.5.2.5.3, 5.5.2.8.12, 5.5.2.8.38, 5.5.2.9.20.
System Administration	Yes	Software Upgrade/Downgrade and Configuration Backup/Restoral Options (R)	UCR 2008, Section 5.5.2.8.40, 5.5.2.8.43, 5.5.2.8.44, 5.5.2.8.45, 5.5.2.8.39.
		Wavelength Management Options (Tuning, Addition and Deletion of Wavelength) (R)	UCR 2008, Section 5.5.2.5.1, 5.5.2.5.2, 5.5.2.1.13, 5.5.2.11.12, 5.5.2.11.13, 5.5.2.11.19.
System Performance	Yes	System Protection Options (Manual and Automatic Path Protection and Restoral) (R) Voice over Internet Protocol Session Initiation Protocol and H.323 performance via Gigabit Ethernet (R)	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29, DISN-OTS-IOP-17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27. UCR 2008, Section 5.3.3.4.1, 5.3.3.5.1, 5.3.3.6.1
System Protection	Yes	System Protection Options (Manual and Automatic Path Protection and Restoral) (R)	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29, DISN-OTS-IOP-17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27.
Security (Information Assurance)	Yes	Defense Information Assurance Certification and Accreditation Process and Security Technical Implementation Guides (R)	UCR 2008 Section A9.6

NOTES:
1 These interfaces are not supported by the system and have not been tested.

LEGEND:

BERT	Bit Error Ratio Test	NMS	Network Management System	STM	Synchronous Transport Module
C	Conditional	OC	Optical Carrier	SUT	System Under Test
DISN	Defense Information Systems Network	ODU	Optical Channel Data Unit	UCR	Unified Capabilities Requirements
EMS	Element Management System	OSC	Optical Supervisory Channel	WAN	Wide Area Network
IOP	Interoperability	OTS	Optical Transport System		
IP	Internet Protocol	OTU	Optical Channel Transport Unit		
LAN	Local Area Network	R	Required		

8. TEST NETWORK DESCRIPTION. The JITC tested the SUT at the Indian Head Advanced Technology Testing (ATT) Laboratory in a manner and configuration similar to the DISN operational environment. Figures 2-2 through 2-4 illustrates the test configurations.

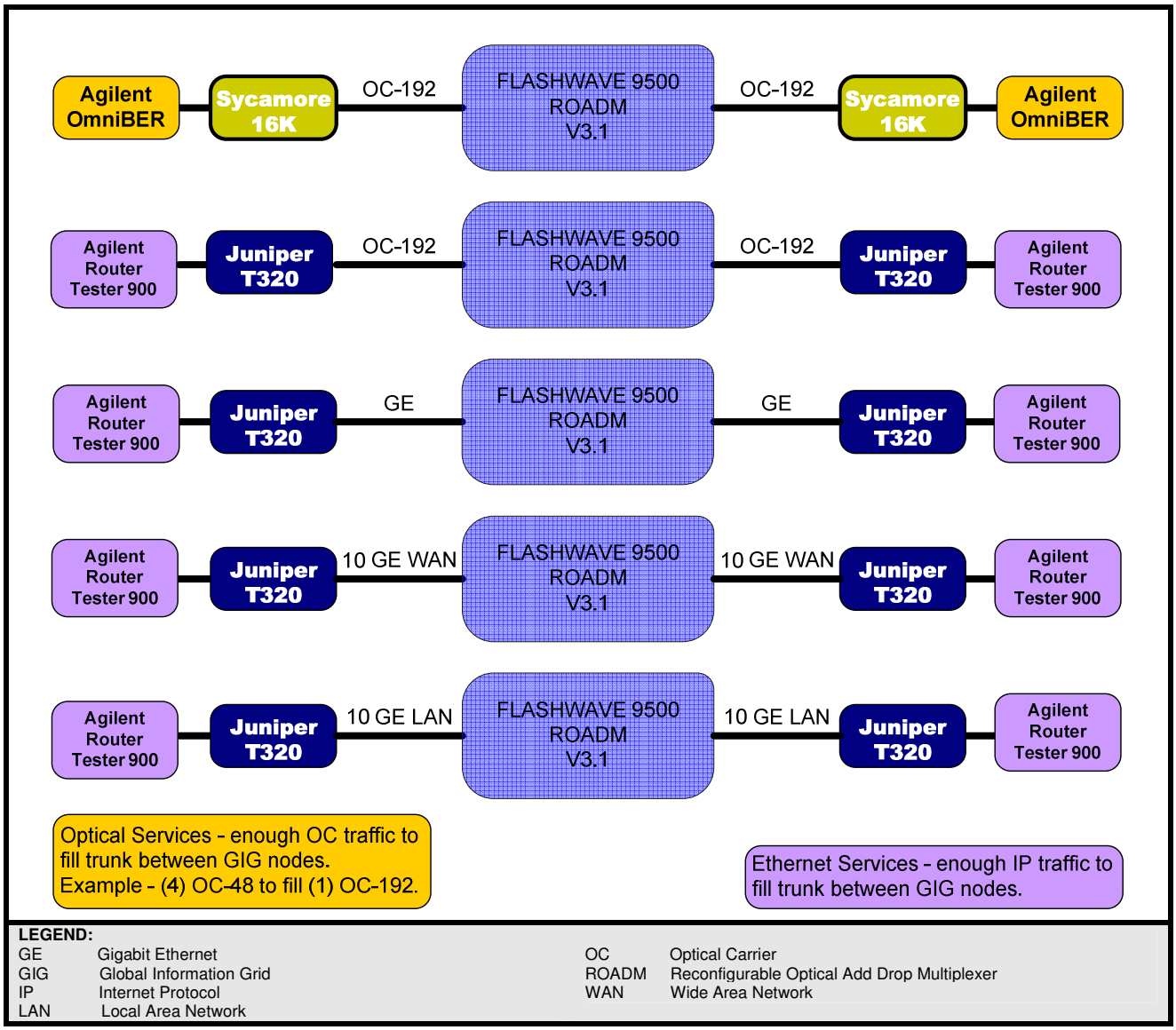


Figure 2-2. Interoperability Test Configuration 1

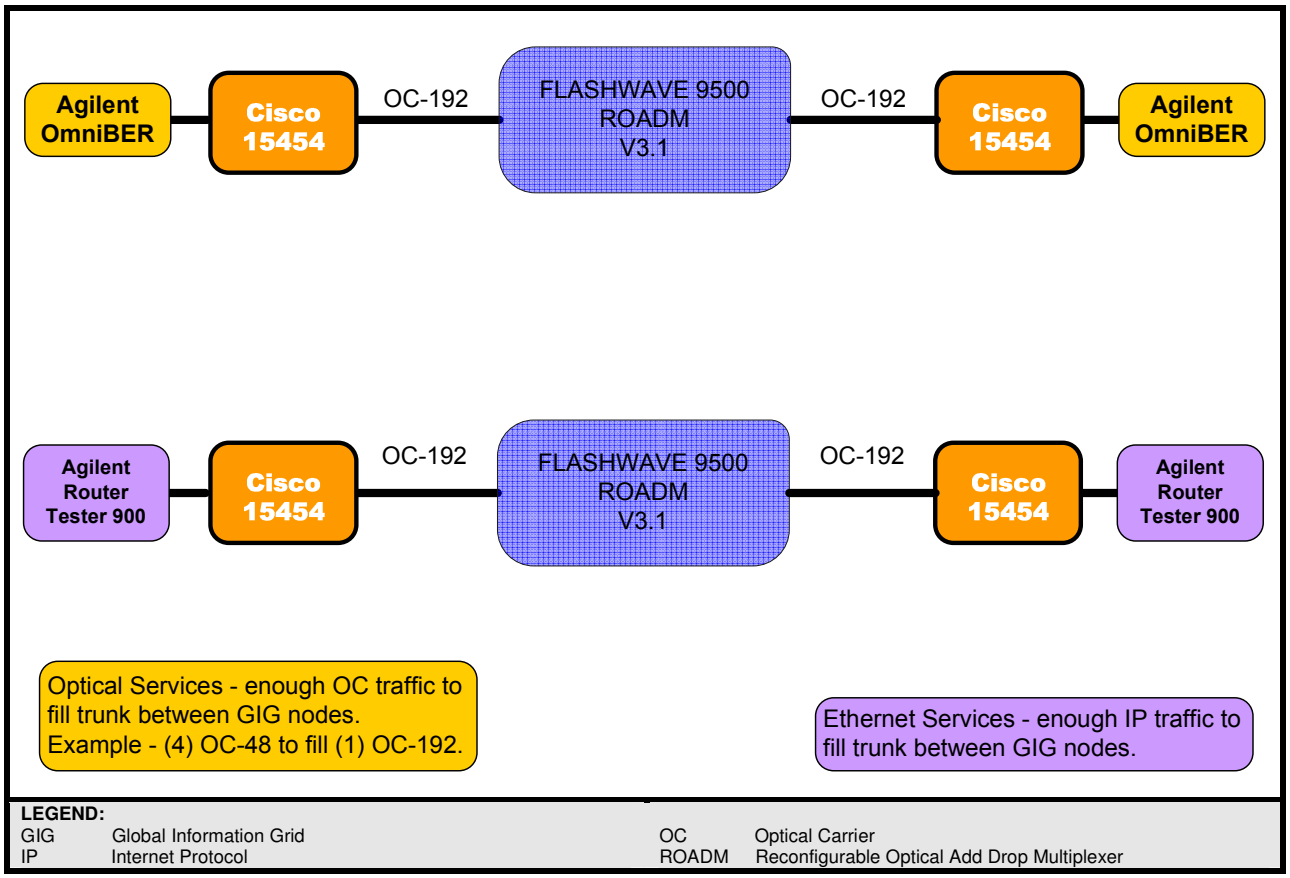
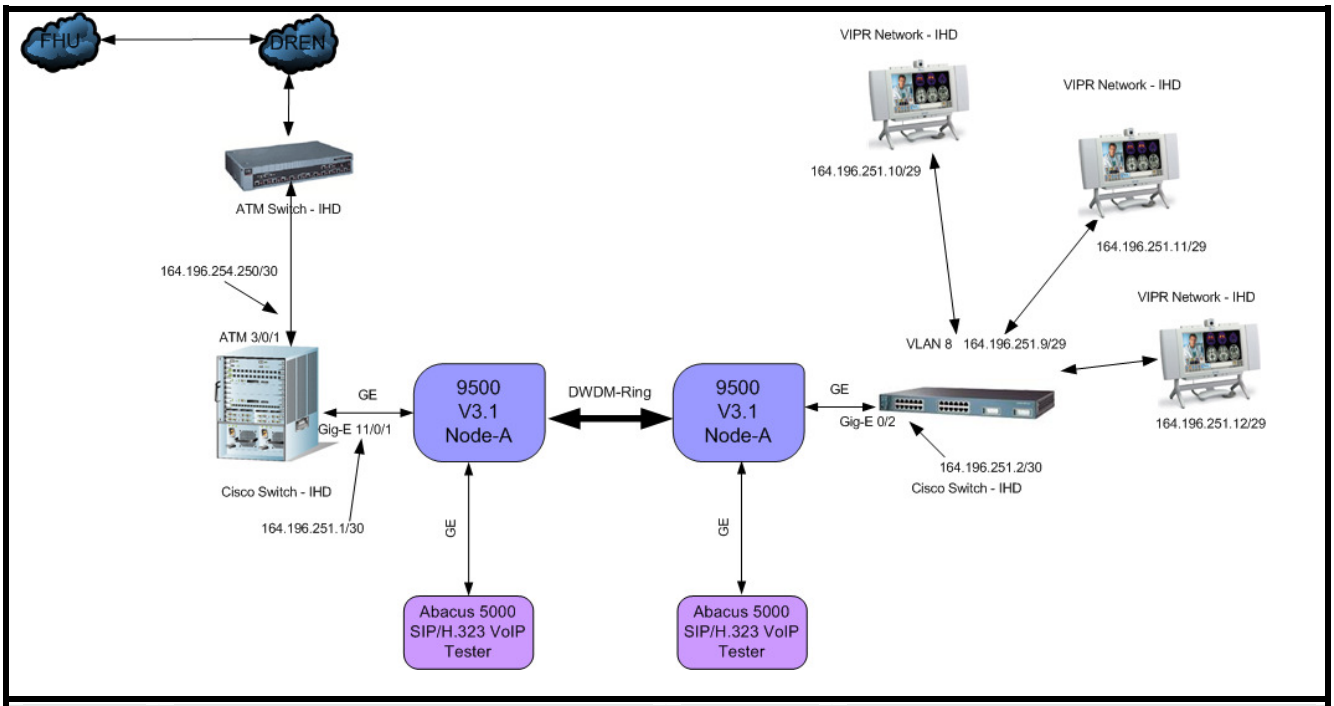


Figure 2-3. Interoperability Test Configuration 2



LEGEND:

ATM	Asynchronous Transfer Mode	Gig-E	Gigabit Ethernet
DREN	Defense Research and Engineering Network	IXIA	Brand Name (Not an acronym)
DWDM	Dense Wavelength Division Multiplexing	SIP	Session Initiation Protocol
FHU	Fort Huachuca Arizona	VIPR	Virtual Presence
IHD	Indian Head Maryland	VLAN	Virtual Local Area Network
GE	Gigabit Ethernet		

Figure 2-4. Interoperability Test Configuration 3

9. SYSTEM CONFIGURATIONS. Table 2-3 lists the system configurations, Table 2-4 lists the Non-SUT equipments, and Table 2-5 lists the test equipments used in the test. The JITC tested the SUT as DISN-OTS in an operationally realistic environment to determine interoperability with other DISN Architecture components listed in Table 2-6.

Table 2-3. Tested System Configuration

SYSTEM NAME	SOFTWARE RELEASE	
FLASHWAVE 9500 ONP with DWDM based ROADM feature.	Release 3.1	
NetSmart 500 EMS. *Only used for configuration purposes and is not certified under the SUT.	Release 3.12.0	
NetSmart 1500 NMS. *Only used for configuration purposes and is not certified under the SUT.	Release 6.0.0	
CARD NAME	**PART NUMBER**	**NUMBER OF ITEMS**
Combo OC-3/12/48/GE card (8-port)*	FC9565CMD1*	1
OC-192 SONET card (2-port)*	FC9565S9B1*	1
G.709 OTU-2 card using tunable laser (1-port)*	FC9565STA2*	1
10 Gig Universal Transponder (Client XFP Pluggable)	FC9565TBA1	1
20-port Gigabit Ethernet Card (SFP pluggable)	FC9565EGS1	1
2-port 10G Ethernet Card (Client XFP pluggable)	FC9565EXX1	1
10GE NBO Card (double width)	FC9565ETA1	1
Multi-rate (OC3/12/48, GbE) Short Reach	FC95700160	1
Multi-rate (OC3/12/48, GbE) Intermediate Reach -1	FC95700170	1
Multi-rate CWDM (OC3/12/48/GE) 1610 nm	FC9570B40A	1
Multi-rate CWDM (OC3/12/48/GE) 1470 nm	FC9570B40H	1
OC-3 Intermediate Reach -1	FC95700021	2
OC-12, Intermediate Reach -1 SFP	FC95700051	2
OC-48 Short Reach -1	FC95700080	2
OC-192 Short Reach -1/10G Base Long Reach /10GE	FC9573D410	4
STM-1 Enhanced	FC95700200	2
OC-48 SFP - 1530.33nm, 195.9THz, ITU Channel 59	FC95704AAC	2
OC-48 SFP - 1560.61nm, 192.1THz, ITU Channel 21	FC95704ABS	2
*NETSMART 1500, v6.0 server	PWR-QNUM-75132-1	1

LEGEND:

CWDM	Coarse Wavelength Division Multiplexing	SUT	System Under Test
EMS	Element Management System	SFP	Small Form Factor Pluggable
NMS	Network Management System	XFP	10 Gigabit Small Form Factor Pluggable
nm	Nanometer		
OC	Optical Carrier		
ONP	Optical Network Platform		
ROADM	Reconfigurable Add Drop Multiplexer		

*1 The UCR does not stipulate a minimum network-management system requirement for an Optical Transport System.

Table 2-4. Non-SUT Equipment

DISN EQUIPMENTS	SOFTWARE VERSION	INTERFACE CARDS
Cisco 15454	09.00-008I-17.17	ETH 100T-12-G, OC-3IR-STM1 SH-1310-8, OC-12IR-STM4-1310-4, DS-1N-14, G1K-4, OC-192SR/STM-64, OC-48 AS-IR-1310, DS-3N-12E
Sycamore ODXC	7.6.21 Build 0562.26.27.57.14	GPIC2 2 X OC-192/STM-64, GPIC 24 x OC-3-12/STM1-4IR, GPIC2 8 x OC-48/STM16, USC - OC-192 LR 2c LIM 1
Juniper T320 Router	9.2.R2.15	4 x FE 100 Base Tx, 10 x GigE LAN 1000 Base, 1x OC-192 SM SR2, 1 x 10GigE LAN, XENPAK

LEGEND:

DS	Digital Signal	ODXC	Optical Digital Cross Connect
ETH	Ethernet	R	Revision
GigE	Gigabit Ethernet	SM	Single Mode
LAN	Local Area Network	SR	Short Reach
LIM	Line Interface Module	Tx	Transmit
OC	Optical Carrier	USC	Universal Services Card

Table 2-5. Test Equipment

Manufacturer	Type	Port Type	Software Version
Agilent	Optical Tester	1550 nm	A.06.01
		1310 nm	
	Router Tester 900	OC-3/OC-12 /POS	6.11
		OC-48 Multilayer	
		1000 Base X	
Ixia	Traffic generator	10 Gig	5
		LM1000STX	
Digital Lightwave	Optical Wavelength Manager	Monitor Ports	2.4.0
Spirent Abacus	Bulk Call Generator	T1-RJ45/RJ11	6.0.r20
Agilent	Rack Mounted Router Tester 900	10 Gig LAN/WAN	6.11
		10/100/1000 Base-T	
		1000 Base-X	
		OC-48c POS	
		OC-3/12/POS	
Agilent JDSU	T-Berd 8000	OC-192 POS	6.11
		DSU	6.4
		10/100/1000	
		OC-3-12	
		DS-3	
		OC-192	

LEGEND:

DS	Digital Signal	nm	Nanometer
DSU	Data Services Unit	OC	Optical Carrier
Gig	Gigabit	POS	Packet Over Synchronous Optical Network
LAN	Local Area Network	WAN	Wide Area Network

10. TEST LIMITATIONS.

- SONET standard interfaces OC-48 and OC-768 are not supported by the system and have not been tested.
- SDH standard interfaces STM-16 and STM-256 are not supported by the system and have not been tested.
- OTN standard interfaces OTU3/ODU3 is not supported by the system and has not been tested.

11. TEST RESULTS

a. Discussion

(1) SUT Certified Interfaces for DISN Architecture. The SUT supports SONET/SDH standard optical carrier interfaces of OC-192/STM-64, and Gigabit Ethernet (GigE) standard interfaces of GigE, 10 GigE LAN, 10 GigE WAN and OTN standard interfaces of OTU1/ODU1, OTU2/ODU2 for to transport all of the DISN services, and all of these interfaces were verified in accordance with the applicable UCR 2008 requirements, DISN-OTS-IOP-requirements, and review of vendor LOC documentation. The Table 2-6 represents the respective interface those were tested and certified for the DISN architectures, Table 2-7 represents the UCR Test Results summery and Table 2-8 represents the OTS DISN-IOP Test Results summery.

Table 2-6. SUT Certified Interfaces for DISN Architecture

SUT Certified Interface	DISN Architecture
STM-64	For UCR Compliance Only, No Current DISN-OTS-IOP Requirements.
OTU1/ODU1	For UCR Compliance Only, No Current DISN-OTS-IOP Requirements.
OTU2/ODU2	For UCR Compliance Only, No Current DISN-OTS-IOP Requirements.
OC-192	DISN-MSPP, DISN-ODXC, and DISN-IP-Router
Gigabit Ethernet	DISN-IP-Router, and Transparent Transport of VoIP H.323/SIP Signaling and Data Traffic
10 Gigabit Ethernet-WAN	DISN-IP-Router
10 Gigabit Ethernet-LAN	DISN-IP-Router

LEGEND:

DISN	Defense Information Systems Network	OTS	Optical Transport System
IOP	Interoperability	OUT	Optical Channel Transport Unit
IP	Internet Protocol	SIP	Session Initiation Protocol
LAN	Local Area Network	STM	Synchronous Transport Module
MSPP	Multi-Services Provisioning Platform	SUT	System Under Test
ODXC	Optical Digital Cross Connect	UCR	Unified Capabilities Requirements
OC	Optical Carrier	VoIP	Voice over Internet Protocol
ODU	Optical Channel Data Unit	WAN	Wide Area Network

(2) Impact Assessment. SONET standard interfaces OC-48 and OC-768, SDH standard interface STM-16 and STM-256, and OTN standard interface OTU3/ODU3 are not supported by the system and have not been tested and it may negatively impact an installation where these interfaces are critically required.

(3) Security. The UCR, appendix 9, paragraph A9.6, states that the NE shall conform to the requirements outlined in DoD Instruction 8510.bb, “DoD Information

Assurance Certification and Accreditation Process," and the applicable DISN Security Technical Implementation Guides. The JITC evaluated security as part of the Information Assurance testing and published the results in a separate report (see reference [d]).

b. Summary. The SUT is certified for joint use within the DISN as an OTS Element in accordance with the requirements set forth in reference (c). When connected to the interfaces certified in this letter, the SUT and its associated interfaces were transparent to the other DISN elements interfaces causing no degradation of service or negative impact, and met all the required interface and capability and feature requirements, except as noted in paragraph 10 and this paragraph.

12. TEST AND ANALYSIS REPORT. In accordance with the Program Manager's request, the JITC did not prepare a detailed test report, but Table 2-7, UCR Test Results, and Table 2-8, OTS DISN-Interoperability Test Results, provide a summery report for the actual testing. JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program, which .mil/gov users can access on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (Secure Internet Protocol Router Network).

Table 2-7. 9500 UCR Test Results

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
UCR-01	**Title:** Internal Bit Error Rate Test. **Objective:** Determine the functionality of the internal BER features of a system node.	**Required Result:** Internal BER Test capability toward network properly tests end-to-end network circuit connectivity and performance. **Actual Results:** Internal BER Test capability toward network properly tested end-to-end network circuit connectivity and performance.	UCR 2008, Section 5.5.2.5.3
UCR-02	**Title:** OC-48 Support (System does not support this interface) **Objective:** Validate interface configuration, connectivity, and measure the OC-48 BER.	**Required Result:** BER is 10^{-12} or less. **Actual Results:** Not Tested.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.1
UCR-03	**Title:** OC-192 Support **Objective:** Validate interface configuration, connectivity, and measure the OC-192 BER.	**Required Result:** BER is 10^{-12} or less. **Actual Results:** Zero Bit Error.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
UCR-04	**Title:** STM-64 Support **Objective:** Validate interface configuration, connectivity, and measure the STM-64 BER.	**Required Result:** BER is 10^{-12} or less. **Actual Results:** Zero Bit Error.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.5, 5.5.2.6.2
UCR-05	**Title:** OC-768 Support (System does not support this interface) **Objective:** Validate interface configuration, connectivity, and measure the OC-768 BER.	**Required Result:** BER is 10^{-12} or less. **Actual Results:** Not Tested.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6

Table 2-7. 9500 UCR Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
UCR-06	**Title:** STM-256 Support (System does not support this interface) **Objective:** Validate interface configuration, connectivity, and measure the STM-256 BER.	**Required Result:** BER is 10^{-12} or less. **Actual Results:** Not Tested.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.1, 5.5.2.1.2.1.4, 5.5.2.1.2.1.7, 5.5.2.6.6
UCR-07	**Title:** GigE Support **Objective:** Validate supported interface configuration, connectivity, and measure end-to-end frame loss.	**Required Result:** The frame loss is less than 0.1% at a load of 100%. **Actual Results:** The frame loss was less than 0.1% at a load of 100%.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.3
UCR-08	**Title:** 10 GigE LAN Support **Objective:** Validate supported interface configuration, connectivity and measure end-to-end frame loss.	**Required Result:** The frame loss is less than 0.1% at a load of 100%. **Actual Results:** The frame loss was less than 0.1% at a load of 100%.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.5
UCR-09	**Title:** 10 GigE WAN Support **Objective:** Validate supported interface configuration, connectivity and measure end-to-end frame loss.	**Required Result:** The frame loss is less than 0.1% at a load of 100%. **Actual Results:** The frame loss was less than 0.1% at a load of 100%.	UCR 2008, Section 5.5.2.1.1.7, 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.1.2.1.4, 5.5.2.1.2.1.6, 5.5.2.6.4
UCR-10	**Title:** GigE Frame Loss **Objective:** OTS shall support the transport of the GigE with constant load and measure the percentage of frames not forwarded due to lack of resources.	**Required Result:** Validates card configuration, connectivity, and throughput. **Actual Results:** Properly validated card configuration, connectivity, and throughput.	UCR 2008, Section 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.6.3
UCR-11	**Title:** 10 GigE WAN PHY Frame Loss **Objective:** OTS shall support the transport of the 10 GigE WAN with constant load and measure the percentage of frames not forwarded due to lack of resources.	**Required Result:** Validates card configuration, connectivity, and throughput. **Actual Results:** Properly validated card configuration, connectivity, and throughput.	UCR 2008, Section 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.6.4
UCR-12	**Title:** 10 GigE LAN Frame Loss **Objective:** OTS shall support the transport of the 10 GigE LAN with constant load and measure the percentage of frames not forwarded due to lack of resources.	**Required Result:** Validates card configuration, connectivity, and throughput. **Actual Results:** Properly validated card configuration, connectivity, and throughput.	UCR 2008, Section 5.5.2.1.1.14, 5.5.2.1.2.1.2, 5.5.2.6.5
UCR-13	**Title:** Power Source Failures **Objective:** Verify that a redundant or non-service affecting module or power source for the system allow for error-free operation upon a simulated failure of the primary module/source.	**Required Result:** If one of the power units fails, an alarm shall be generated and the load shall be carried by the other unit without manual intervention and without interruption of service or functionality. The other power unit shall support the operation of the element/shelf/circuit pack until the problem with the faulty unit is corrected. **Actual Results:** When one of the power units failed, an alarm was generated and the load was carried by the other unit without manual intervention and without interruption of service or functionality. The other power unit had supported the operation of the element/shelf/circuit pack until the problem with the faulty unit was corrected.	UCR 2008, Section 5.5.2.8.12
UCR-14	**Title:** Software Upgrade Capability **Objective:** OTS shall have software upgrade capability in a modular fashion, and software rollback capability to previous version, software upgrade shall also use or provide translation of previous version's configuration database, and user has an accessible file system.	**Required Result:** There should be no bit errors occur during software upgrade. **Actual Results:** There were no bit errors occur during software upgrade.	UCR 2008, Section 5.5.2.8.40, 5.5.2.8.43, 5.5.2.8.44, 5.5.2.8.45

Table 2-7. 9500 UCR Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
UCR-15	**Title:** Node Configuration **Objective:** Backup and Restore. Verify the equipment configuration can be saved to an external location and restored from an external location.	**Required Result:** All data services must be restore to their original state at the completion of system back up and restore operation. **Actual Results:** All data services were restored to their original state at the completion of system back up and restore operation.	UCR 2008, Section 5.5.2.8.39
UCR-16	**Title:** Optical Supervisory Channel **Objective:** OTS shall include an OSC linking the two OTS GNE, with access at each OTS OLA site. All telemetry, data, and voice traffic originating at OTS OLA sites shall be routed over this service channel.	**Required Result:** It is possible to remotely configure and control equipment via OSC. Communication is not lost when the connection to the primary GNE is removed. **Actual Results:** It was possible to remotely configure and control equipment via OSC. Communication is not lost when the connection to the primary GNE is removed.	UCR 2008, Section 5.5.2.1.1.6, 5.5.2.10
UCR-17	**Title:** Wavelength Tunability **Objective:** Verify that tributary cards can be tuned to all of the wavelength channels available on the system.	**Required Result:** The tributary card is tunable to all of the wavelengths channels available on the system. **Actual Results:** The tributary card was tunable to all of the wavelengths channels available on the system.	UCR 2008, Section 5.5.2.5.1, 5.5.2.5.2
UCR-18	**Title:** Addition of Wavelengths **Objective:** Determine the capability of the system to add wavelengths without affecting other services transported by the system.	**Required Result:** Zero bit errors occur when wavelengths are added. **Actual Results:** Zero bit errors occurred when wavelengths are added.	UCR 2008, Section 5.5.2.1.13, 5.5.2.11.12, 5.5.2.11.13, 5.5.2.11.19.
UCR-19	**Title:** Deletion of Wavelengths **Objective:** Determine the capability of the system to delete wavelengths without affecting other services transported by the system	**Required Result:** Zero bit errors occur when wavelengths are dropped. **Actual Results:** Zero bit errors occurred when wavelengths are dropped.	UCR 2008, Section 5.5.2.1.13, 5.5.2.11.12, 5.5.2.11.13, 5.5.2.11.19
UCR-20	**Title:** House Keeping Alarms **Objective:** Verify that system's primary OS interface shall provide the capability for reporting alarms of external equipment and general housekeeping alarms. A minimum of 16 user-defined alarms shall be provided, with the option to expand to 32 user-defined alarm points. Capability shall be provided for minimum of 8 user-defined remote control points for external functions. This capability shall be provide by relays, not TTL.	**Required Result:** System's primary OS interface shall provide the capability for reporting alarms of external equipment and general housekeeping alarms. A minimum of 16 user-defined alarms shall be provided, with the option to expand to 32 user-defined alarm points. Capability shall be provided for minimum of eight user defined remote control points for external functions. This capability shall be provide by relays, not TTL. **Actual Results:** System's primary OS interface had provided the capability for reporting alarms of external equipment and general housekeeping alarms. 16 user-defined alarms were provided. Capability was provided for four user defined remote control points for external functions. This capability was provided via relays, not via TTL.	UCR 2008, Section 5.5.2.8.38
UCR-21	**Title:** Automatic Laser Shutdown or Automatic Laser Power Down to a Safe Power Level **Objective:** Verify that an automatic laser shutdown or automatic laser power down to a safe power level occurs in the event of a fiber cut.	**Required Result:** Automatic laser shutdown or automatic laser power down to a safe power level occurs when fiber connectivity is interrupted. **Actual Results:** Automatic laser shutdown or automatic laser power down to a safe power level occurred when fiber connectivity was interrupted.	UCR 2008, Section 5.5.2.9.20

Table 2-7. 9500 UCR Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
UCR-22	**Title:** EMS/NMS Optical Protection Switch Times-SONET **Objective:** Verify that O-UPSR protection can be managed by a user within acceptable switch times for SONET traffic.	**Required Result:** Switch time is less than or equal to 60 milliseconds (10 milliseconds for signaling plus 50 milliseconds for switching). **Actual Results:** Switch time was less than 60 milliseconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-23	**Title:** EMS/NMS Optical Protection Switch Times-SDH **Objective:** Verify that O-UPSR protection can be managed by a user within acceptable switch times for SDH traffic.	**Required Result:** Switch time is less than or equal to 60 milliseconds (10 milliseconds for signaling plus 50 milliseconds for switching). **Actual Results:** Switch time was less than 60 milliseconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-24	**Title:** OC-192 Optical Protection Automatic Switch Times **Objective:** Verify OC-192 service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 milliseconds (10 milliseconds for signaling plus 50 milliseconds for switching). **Actual Results:** Switch time was less than 60 milliseconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-25	**Title:** OC-48 Optical Protection Automatic Switch Times (System does not support this interface) **Objective:** Verify OC-48 service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 milliseconds (10 milliseconds for signaling plus 50 milliseconds for switching). **Actual Results:** Not Tested.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-26	**Title:** STM-64 Optical Protection Automatic Switch Times **Objective:** Verify STM-64 service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 milliseconds (10 milliseconds for signaling plus 50 milliseconds for switching). **Actual Results:** Switch time was less than 60 milliseconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-27	**Title:** GigE Optical Protection Automatic Switch Times **Objective:** Verify GigE service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 seconds. **Actual Results:** Switch time was less than 60 seconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-28	**Title:** 10 GigE LAN Optical Protection Automatic Switch Times **Objective:** Verify 10 GigE LAN service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 seconds. **Actual Results:** Switch time was less than 60 seconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-29	**Title:** 10 GigE WAN Optical Protection Automatic Switch Times **Objective:** Verify 10 GigE WAN service is automatically protected by the O-UPSR within acceptable switch times.	**Required Result:** Switch time is less than or equal to 60 seconds. **Actual Results:** Switch time was less than 60 seconds.	UCR 2008, Section 5.5.2.11.23, 5.5.2.11.24, 5.5.2.11.25, 5.5.2.11.26 5.5.2.11.27, 5.5.2.11.28, 5.5.2.11.29
UCR-30	**Title:** Session Initiation Protocol (SIP) Voice over Internet Protocol (VoIP) One-way Latency **Objective:** Verify that one-way latency of an E2E SIP simulated system supporting VoIP is 150 ms or less between two nodes as averaged over any 5-minute threshold period.	**Required Result:** The one-way latency of an E2E SIP simulated system supporting VoIP is 150 ms or less between two nodes as averaged over any 5-minute threshold period. **Actual Results:** The one-way latency of an E2E SIP simulated system supporting VoIP was less than 8 ms between two nodes as averaged over any 5-minute threshold period.	UCR 2008, Section 5.3.3.4.1

Table 2-7. 9500 UCR Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
UCR-31	**Title:** SIP VoIP Packet Loss **Objective:** Verify that packet loss of an E2E SIP simulated system supporting VoIP is 1.0 percent or less between two nodes as averaged over any 5-minute period.	**Required Result:** The packet loss of an E2E SIP simulated system supporting VoIP is 1.0 percent or less between two nodes as averaged over any 5-minute period. **Actual Results:** The packet loss of an E2E SIP simulated system supporting VoIP was 0 percent between two nodes as averaged over any 5-minute period.	UCR 2008, Section 5.3.3.6.1
UCR-32	**Title:** SIP VoIP Jitter **Objective:** Verify that jitter of an E2E SIP simulated system supporting VoIP is 15 ms or less between two nodes during any 5-minute period.	**Required Result:** The jitter of an E2E SIP simulated system supporting VoIP is 15 ms or less between two nodes during any 5-minute period. **Actual Results:** The jitter of an E2E SIP simulated system supporting VoIP was less than 7 ms between two nodes during any 5-minute period.	UCR 2008, Section 5.3.3.5.1
UCR-33	**Title:** H.323 VoIP One-way Latency **Objective:** Verify that one-way latency of an E2E H.323 simulated system supporting VoIP is 150 ms or less between two nodes as averaged over any 5-minute threshold period.	**Required Result:** The one-way latency of an E2E H.323 simulated system supporting VoIP is 150 ms or less between two nodes as averaged over any 5-minute threshold period. **Actual Results:** The one-way latency of an E2E H.323 simulated system supporting VoIP was less than 6 ms between two nodes as averaged over any 5-minute threshold period.	UCR 2008, Section 5.3.3.4.1
UCR-34	**Title:** H.323 VoIP Packet Loss **Objective:** Verify that packet loss of an E2E H.323 simulated system supporting VoIP is 1.0 percent or less between two nodes as averaged over any 5-minute period.	**Required Result:** The packet loss of an E2E H.323 simulated system supporting VoIP is 1.0 percent or less between two nodes as averaged over any 5-minute period. **Actual Results:** The packet loss of an E2E H.323 simulated system supporting VoIP was 0 percent between two nodes as averaged over any 5-minute period.	UCR 2008, Section 5.3.3.6.1
UCR-35	**Title:** H.323 VoIP Jitter **Objective:** Verify that jitter of an E2E H.323 simulated system supporting VoIP is 15 ms or less between two nodes during any 5-minute period.	**Required Result:** The jitter of an E2E H.323 simulated system supporting VoIP is 15 ms or less between two nodes during any 5-minute period. **Actual Results:** The jitter of an E2E H.323 simulated system supporting VoIP was less than 6 ms between two nodes during any 5-minute period.	UCR 2008, Section 5.3.3.5.1

LEGEND:

BER	Bit Error Ratio	OTS	Optical Transport System
E2E	End-to-End	PHY	Physical
GigE	Gigabit Ethernet	SDH	Synchronous Digital Hierarchy
GNE	Gateway Network Element	SONET	Synchronous Optical Network
LAN	Local Area Network	STM	Synchronous Transport Module
NMS	Network Management System	TTL	Time to Live
OC	Optical Carrier	UCR	Unified Capabilities Requirements
OLA	Optical Line Amplifier	VoIP	Voice over Internet Protocol
OSC	Optical Supervisory Channel	WAN	Wide Area Network
O-UPSR	Optical-Unidirectional Path Switched Ring		

Table 2-8. OTS DISN-Interoperability Test Results

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
9500 IOP-01	**Title:** Support of OC-48, OC-192, GigE, and 10 GigE WAN, and 10 GigE LAN interfaces to Transport DISN Services. (System does not support OC-48 interface and has not been tested). **Objective:** OTS shall support OC-48, OC-192/, GigE, 10 GigE WAN, and 10 GigE LAN interfaces to transport DISN services.	**Required Result:** OTS support OC-48, OC-192, GigE, 10 GigE WAN, and 10 GigE LAN interfaces to transport DISN services. **Actual Results:** OTS supported only, OC-192, GigE, 10 GigE WAN, and 10 GigE LAN interfaces to transport DISN services. (System does not support OC-48 interface and has not been tested).	DISN-OTS-IOP-01
9500 IOP-02	**Title:** Transport of DISN-Access GigE Circuit Provisioned via DISN-Access OC-192 Trunk **Objective:** OTS shall transport DISN-Access GigE circuit provisioned via DISN-Access OC-192 trunk across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-02
9500 IOP-03	**Title:** Transport of DISN-Access GigE Circuit Provisioned via DISN-ODXC OC-192 Trunk. **Objective:** OTS shall transport DISN-Access GigE circuit provisioned via DISN-ODXC OC-192 trunk across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-03
9500 IOP-04	**Title:** Transport of DISN-Provider (P) Router GigE Circuit **Objective:** OTS shall transport DISN-P Router GigE circuit across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-04
9500 IOP-05	**Title:** Transport of DISN-Access OC-3 Circuit Provisioned via DISN-Access OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-3 circuit provisioned via DISN-Access OC-192 trunk across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-05
9500 IOP-06	**Title:** Transport of DISN-Access OC-3 Circuit Provisioned via DISN-ODXC OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-3 Circuit provisioned via DISN-ODXC OC-192 trunk across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-06
9500 IOP-07	**Title:** Transport of DISN-Access OC-12 Circuit Provisioned via DISN-Access OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-12 circuit provisioned via DISN-Access OC-192 trunk across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-07
9500 IOP-08	**Title:** Transport of DISN-Access OC-12 Circuit Provisioned via DISN-ODXC OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-12 circuit provisioned via DISN-ODXC OC-192 trunk across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-08

Table 2-8. OTS DISN-Interoperability Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
9500 IOP-09	**Title:** Transport of DISN-Access OC-48 Circuit Provisioned via DISN-Access OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-48 circuit provisioned via DISN-Access OC-192 trunk across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-09
9500 IOP-10	**Title:** Transport of DISN-Access OC-48 Circuit Provisioned via DISN-ODXC OC-192 Trunk **Objective:** OTS shall transport of DISN-Access OC-48 circuit provisioned via DISN-ODXC OC-192 Trunk across OTS	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-10
9500 IOP-11	**Title:** Transport of DISN-Access OC-192 Circuit **Objective:** OTS shall transport of DISN-Access OC-192 circuit across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-11
9500 IOP-12	**Title:** Transport of DISN-ODXC OC-192 Circuit **Objective:** OTS shall transport of DISN-ODXC OC-192 circuit across OTS.	**Required Result:** The end-to-end BER is less than 10^{-12}. **Actual Results:** Zero Bit Error.	DISN-OTS-IOP-12
9500 IOP-13	**Title:** Transport of DISN-P Router OC-192 Circuit **Objective:** OTS shall transport DISN-P Router OC-192 circuit across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-13
9500 IOP-14	**Title:** Transport of DISN-P Router OC-192 circuit Provisioned via DISN-ODXC OC-192 Trunk **Objective:** OTS shall transport DISN-P Router OC-192 circuit provisioned via DISN-ODXC OC-192 trunk across OTS	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-14
9500 IOP-15	**Title:** Transport of DISN-P Router 10 GigE LAN Circuit **Objective:** OTS shall transport DISN-P Router GigE LAN circuit across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-15
9500 IOP-16	**Title:** Transport of DISN-P Router 10 GigE WAN Circuit **Objective:** OTS shall transport DISN-P Router GigE WAN circuit across OTS.	**Required Result:** The end-to-end frame loss is less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes. **Actual Results:** The end-to-end frame loss was less than 0.1% at a load of 100% of line rate for all RFC-2544 specified frame sizes.	DISN-OTS-IOP-16
9500 IOP-17	**Title:** Protection of Transported DISN-P Router GigE Service **Objective:** OTS shall provide protected path for transported DISN-P Router GigE service.	**Required Result:** The switch time for GigE circuit is less than or equal to 60 seconds. **Actual Results:** Switch time was less than 60 seconds.	DISN-OTS-IOP-17
9500 IOP-18	**Title:** Protection of Transported DISN-P Router 10 GigE LAN Service **Objective:** OTS shall provide protected path for transported DISN-P Router 10 GigE LAN service.	**Required Result:** The switch time for 10 GigE LAN circuit is less than or equal to 60 seconds. **Actual Results:** Switch time of 10 GigE LAN was less than 60 seconds.	DISN-OTS-IOP-18

Table 2-8. OTS DISN-Interoperability Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
9500 IOP-19	**Title:** Protection of Transported DISN-Access OC-48 Service. (System does not support OC-48 interface and has not been tested). **Objective:** OTS shall provide protected path for transported DISN-Access OC-48 Service.	**Required Result:** The BER is less than 10^{-12}, and switch time for OC-48 circuit is less than or equal to 60 milliseconds. **Actual Results:** System does not support OC-48 interface and has not been tested.	DISN-OTS-IOP-19
9500 IOP-20	**Title:** Protection of Transported DISN-ODXC OC-48 Service (System does not support OC-48 interface and has not been tested). **Objective:** OTS shall provide protected path for transported DISN-ODXC OC-48 Service.	**Required Result:** The BER is less than 10^{-12}, and switch time for OC-48 circuit is less than or equal to 60 milliseconds. **Actual Results:** System does not support OC-48 interface and has not been tested.	DISN-OTS-IOP-20
9500 IOP-21	**Title:** Protection of Transported DISN-Access OC-192 Service **Objective:** OTS shall provide protected path for transported DISN-Access OC-192 Service.	**Required Result:** The BER is less than 10^{-12}, and switch time for OC-192 circuit is less than or equal to 60 milliseconds. **Actual Results:** Switch time of OC-192 was less than 60 milliseconds.	DISN-OTS-IOP-21
9500 IOP-22	**Title:** Protection of Transported DISN-ODXC OC-192 Service **Objective:** OTS shall provide protected path for transported DISN-ODXC OC-192 Service.	**Required Result:** The BER is less than 10^{-12}, and switch time for OC-192 circuit is less than or equal to 60 milliseconds. **Actual Results:** Zero Bit Error and Switch time of OC-192 was less than 60 milliseconds.	DISN-OTS-IOP-22
9500 IOP-23	**Title:** Protection of Transported DISN-P Router OC-192 Service **Objective:** OTS shall provide protected path for transported DISN-P Router OC-192 Service.	**Required Result:** The BER is less than 10^{-12}, and switch time for OC-192 circuit is less than or equal to 60 seconds. **Actual Results:** Zero Bit Error and Switch time of OC-192 was less than 60 milliseconds.	DISN-OTS-IOP-23
9500 IOP-24	**Title:** Transport of DISN-Access Protected OC-48 Service (System does not support OC-48 interface and has not been tested). **Objective:** OTS shall transport of DISN-Access protected OC-48 service across the OTS equipment transparently via two non-protected circuits.	**Required Result:** The switch time for OC-48 circuit is less than or equal to 60 milliseconds. **Actual Results:** System does not support OC-48 interface and has not been tested.	DISN-OTS-IOP-24
9500 IOP-25	**Title:** Transport of DISN-ODXC Protected OC-48 Service (System does not support OC-48 interface and has not been tested). **Objective:** OTS shall transport of DISN-ODXC protected OC-48 Service across the OTS equipment transparently via two non-protected circuits.	**Required Result:** The switch time for OC-48 circuit is less than or equal to 60 milliseconds. **Actual Results:** System does not support OC-48 interface and has not been tested.	DISN-OTS-IOP-25
9500 IOP-26	**Title:** Transport of DISN-Access Protected OC-192 Service **Objective:** OTS shall transport of DISN-Access protected OC-192 service across the OTS equipment transparently via two non-protected circuits.	**Required Result:** The switch time for OC-192 circuit is less than or equal to 60 milliseconds. **Actual Results:** Switch time was less than 60 milliseconds.	DISN-OTS-IOP-26

Table 2-8. OTS DISN-Interoperability Test Results (continued)

NUMBER	TITLE/OBJECTIVE	RESULTS	MAIN REFERENCES
9500 IOP-27	**Title:** Transport of DISN-ODXC Protected OC-192 Service **Objective:** OTS shall transport of DISN-ODXC protected OC-48 Service across the OTS equipment transparently via two non-protected circuits.	**Required Result:** The switch time for OC-48 circuit is less than or equal to 60 milliseconds. **Actual Results:** Switch time was less than 60 milliseconds.	DISN-OTS-IOP-27

LEGEND:

BER	Bit Error Ratio	OTS	Optical Transport System
DISN	Defense Information Systems Network	P	Provider
GigE	Gigabit Ethernet	RFC	Request for Comment
IOP	Interoperability	SIP	Session Initiation Protocol
LAN	Local Area Network	STM	Synchronous Transport Module
OC	Optical Carrier	VoIP	Voice over Internet Protocol
ODXC	Optical Digital Cross Connect	WAN	Wide Area Network

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